REMARKS

The present application contains claims 1-28 and 31-72. Claims 39, 53, 61 and 64-67 are currently amended. Claims 68-72 are new. While claims 4, 12, 14-16, 25, 31-33, 35, 36, 45-52 and 55-58 are withdrawn, applicant submits that the withdrawn claims are all dependent on claims being examined and that they would thus be included in any patent that includes independent claims from which they are dependent. Withdrawn claims 25, 35 and 36 are also amended. None of the amendments, except for the first amendment to claim 53 are believed to be substantive.

In response to the objections to the specification applicant has resubmitted the amendments objected to. Similarly claims 65-67 have been changed from method to apparatus.

Claims 60-61, 63-64 and 66-67 stand rejected under 35 U.S.C. §112, second paragraph as being indefinite. The Examiner apparently finds the use of the terms “non-scanning” and “steerable” for the same method as being unclear.

Applicant submits that these terms have acquired different meanings in the art as indicated by the entry for these terms in the 1968 Van Nostrand Scientific Encyclopedia, I found:

- in page 1579 - "Scanning: A periodic motion given to the major lobe of an antenna".

- in page 1735 - "Steerable antenna: A directional antenna whose major lobe can be readily shifted in direction".

Scanning is thus seen to be an action in which the major lobe of the antenna is periodically moved to cover a ~~larger~~ large area. Steerable is a mechanical property of an antenna. In general scanning can only be carried out with an antenna that is steerable. However, the *actions* of scanning and steering, as to the antenna, are different. Apparatus claim 53 has been amended to make clear that the antenna is constrained to be non-scanning. As to the method claims which describes actions, this change is not necessary.

Steering of an antenna beam is changing the beam's direction in space. A steerable antenna or beam is an antenna or antenna beam whose direction is capable of being changed. Steering is done occasionally, in order to address a changing need. Steering can be done electronically, by changing phases in an array, or mechanically, by rotating an antenna or a feed.

Scanning means moving the beam in an orderly manner, in order to search or otherwise cover a certain solid angle. It may be useful to use Mercer's (cited by the Examiner.) wording in this context. In his column 1, line 13 he says that the radar has "non scanning ... target search,

detection and tracking ..". In column 2, line 24 and column 4, line 12 he says that the receiving antenna is steerable. These two ideas can coexist, as they do in our invention.

Claims 1, 2, 53, 59-61 and 65-67 stand rejected under 35 U.S.C. §102(b) as being unpatentable over DeBell, US 5,847,673 in view of Mercer, US 3,218,639). Applicant respectfully traverses the rejection and, in view of the following arguments, submits that DeBell in view of Mercer do not provide a *prima facie* case for obviousness. Claims 3, 5,-11, 13, 26-30, 34, 37-40 and 54 stand rejected under 35 U.S.C. §103(a) as being unpatentable over DeBell in view of Mercer alone further in view of various other references.

Applicant respectfully traverses these rejections and submits that in view of the deficiencies in DeBell in view of Mercer in providing a *prima facie* case of obviousness, as described below, which are not corrected by the other references, that there is no *prima facie* case of obviousness. In view of the deficiencies in DeBell in view of Mercer, the rejections of the dependent claims are not separately argued.

The Examiner admits that DeBell does not disclose utilizing a non-scanning beam. However, the Examiner contends that Mercer discloses a radar system which uses a non-scanning beam to detect aircraft from the ground. Applicant agrees to these characterizations of DeBell and Mercer.

Applicant does not agree with the Examiner's contention that it would have been obvious to *replace* the scanning beam of DeBell with a non-scanning beam as taught by Mercer. Applicant understands this contention as meaning that the entire tracking system of DeBell should be replaced by that of Mercer, since applicant can see no logical methodology of combining two tracking systems any other way. Thus, the rejection appears to consist of "take the aircraft platform of DeBell and replace the radar system with that of Mercer." The Examiner provides as motivation for this replacement, that this would overcome known drawbacks of scanning radar, such as the ability to simultaneously track multiple objects in different directions.

Applicant respectfully traverses the rejections and submits that the combination does not provide a *prima facie* case of obviousness. Applicant submits that the radar system of Mercer does not have at least one limitation of claim 1. Furthermore, Applicant submits that the radar system of Mercer is not suitable for use in an aircraft and certainly not for carrying out the objectives of DeBell.

The system of DeBell, is meant to be used for a radar mounted on an aircraft to provide mapping of the terrain and not for collision avoidence. While not explicitly stated, the system of

DeBell is for use only with stationary targets, since the measurement of angle utilizing Doppler returns is only applicable when one of the objects (aircraft or target) is stationary.

The system of Mercer is a ground based system for tracking moving aircraft. Mercer uses a range gated reception to determine when an aircraft enters a "guard ring" at a given distance from the aircraft. The reflected signal is then detected by one of a large number of directed narrow beam receivers, The measured Doppler shifts of the detected targets are translated to radial velocity, from which change of range is computed by simple integration (Mercer, column 5, lines 5-14) The angles (azimuth and elevation) are determined by which antenna (receiver) detects the signal and not by any Doppler shift.

In contrast, the present claim 1 has, *inter alia,* the following limitations:

(b) receiving a Doppler shifted signal that is Doppler frequency shifted by an amount dependent on an angle between a line of flight of the aircraft and scatterers that reflect the transmitted beam;

(c) *determining the angle from the Doppler frequency*; (emphasis added)

The system of Mercer~~,~~ determines the range from the Doppler shift by converting it to radial velocity and integrating the radial velocity. There is no teaching of the determination of the angle *from the Doppler frequency* as required by claim 1. The angles are determined without respect to the actual Doppler frequency.

Thus, claim 1 is not rendered *prima facie* unpatentable with by DeBell in view of Mercer since the radar system of the combination as proposed by the Examiner, namely that of Mercer does not have all the limitations of claim 1.

The combination does not render the invention of claim 1 prima facie *unpatentable* for a second reason, namely the system of Mercer does not appear to be at all suitable for the purpose of DeBell, which is, as indicated above, terrain mapping. Thus a person of skill in the art would not have made the replacement suggested by the Examiner.

Mercer utilizes a system in which a flying object, which is always limited in extent and is considered as a point object by Mercer, is identified as being of interest when it enters a guard ring with a velocity component toward the radar within a given range. This identification takes place if a return Doppler frequency within a given frequency range is detected during a range gate. The return signal is detected by a large number of stationary narrow beams which enables determination of the angle of return. The object is then tracked by one of a large number of tracking radars of the system.

In an aircraft system for mapping stationary objects such as obstacles and ground, these objects enter any range window as a continuum of scatterers. For example, the ground

(especially a mountain) or a wire or a building could be detected by a large number of receivers at the same time and large numbers of receivers would continue to receive reflections having a Doppler frequency in the target range, from the ground, etc., as additional regions of the ground came into the range gate. This would easily overload the tracking, since an infinite number of objects would be detected. Furthermore, since the objects are sometimes very large and almost always continuous, the system of Mercer would be unable to track the detected scatterers, since there would not be any particular scatterer to track.

This, in fact, is probably the reason that DeBell utilizes a scanning radar, since DeBell does not try to *track* any particular scatterer, as would make sense for a ground radar, but rather to get a picture of the entire area being mapped, a sort of radar snapshot, acquired by scanning.

Applicant also points out that it would also not make sense to replace the tracking beams of Mercer (which could be said to be steerable with respect to the target being tracked) since this would run into the same problems as described above. Applicant believes that DeBell scans with a certain beamwidth and then uses the Doppler shift to determine where each scatterer is within the beam, thus gaining some additional resolution over a pure scanning system.

An additional reason why Mercer's system is not suitable for DeBell is that DeBell is looking for good cross range resolution for his SAR/DBS map. Using Doppler analysis, he can achieve good resolutions. As an example, take a cross range resolution of ***five meters***, at a range of 10km (easily achievable by SAR systems when DeBell applied for his patent). This cross range resolution means that a sector on the ground, represented by a Doppler filter resulting from the FFT is 5/10,000 radians wide (less then 0.03°). If DeBell were to use Mercer's system to obtain this angular resolution, he would have to have antenna beams 0.03° wide. To produce such a beamwitdh he would need an aperture 60m wide, if he uses the common wavelength of 3cm, and this is by all means impractical in an airborne use.

Thus, claim 1 is not rendered *prima facie* unpatentable with by DeBell in view of Mercer since the radar system of the combination as proposed by the Examiner, namely that of Mercer on the platform of DeBell is inoperable at least for the purposes of DeBell and perhaps for any airborne purpose.

As to claim 53, applicant has amended claim 53 so that the features that distinguish claim 1 from the cited art (which were previously implicit in the claim) are more explicit. It is patentable at least for substantially the same reason as claim 1.

The dependent claims are patentable at least for the same reason as their parent claims.

Some of the claims are rejected in a manner that is inconsistent. Applicant submits that for this reason they are independently not *prima facie* unpatentable. In particular, the rejections are based on the following statement: "Claims __________ are rejected under 35 U.S.C. 103(a) as being unpatentable as applied to claim 1 above and further in view of _______. The rejections then go on to explain why it would be obvious to add an element not shown in DeBell based on the particular additional prior art cited. However, the rejection of claim 1 *replaces* the radar method and system of DeBell with that of Mercer. Thus, while the Examiner has presented a reason for adding feature of the additional reference to the method of DeBell, he has not presented any reasoning for adding these features to the method of Mercer (which is the radar system of the combination utilized to reject claim 1) which is the radar method and system of the combination proposed by the Examiner in the rejection of claim 1.

Applicant submits that in view of the lack of clear explanation of the rejection of the dependent claims as described above, no *prima facie* case of obviousness was made.

Applicant further submits that in view of the lack of prima facie case for rejection of both claim 1 and the dependent claims, a final rejection in the next office action would be premature.

Claims 68-72 have been added to further define the invention. Claim 68 defines the invention as having either a fixed beam or one which is steerable in only one direction. This corresponds to the limitation of claim 63 which was indicated as providing patentability. Claims 69-72 add the limitation to various ones of the independent claims that the beam is received and transmitted by a same beam.

Applicants wishes to bring to the Examiner's attention that he has misunderstood the applicant's statement regarding PDI, discussed in the rejection of claim 38.

Enclosed is a Description of PDI, taken from Stimson's "Introduction to Airborne Radar", 1983, p. 179-181. It is clear from the text of Stimson, that the whole process of coherent integration (such as FFT) and afterwards the non coherent integration (PDI) is done on a ***single range-Doppler cell***, in order to increase its probability to pass a threshold, in case the cell contains a target. This process is done in parallel on all the range-Doppler cells.

Stimson describes here a technique in which ***consecutive*** results of a number of FFT processes from a ***single range-Doppler cell*** are added together. Paragraph 0165 discloses a technique in which outputs of ***one FFT process*** from ***adjacent range-Doppler cells*** are added together. The process is "equivalent to the well known PDI" in the sense that it produces a processing gain, in the same way as does PDI.

In view of the above arguments and amendments, applicant submits that the claims are patentable.

While applicant has indicated above that the rejections of the dependent claims are improper because they appear to be directed to the radar system of DeBell, while the independent claims are based on replacing the radar of DeBell by that of Mercer, for at least some of the dependent claims, the features to be combined with the parent claims are not applicable to these claims.

As to claim 23, elevation ambiguity occurs, in principle, when the azimuth of an RDC is measured through DF, and the elevation of the RDC is calculated from the azimuth and the angle, as explained in paragraphs 0198 through 0201 of the present application. The ambiguity results from Equation 9 in paragraph 0200, because arc($\cos\phi$) is ambiguous. As an example, if $\cos\phi = 0.5$, then ϕ can be either +60° or -60° (this ambiguity is explicitly mentioned further down in paragraph 0223).

In DeBell's system, (and judging from his Fig. 4), the beam pattern on the ground is narrow enough to see only the correct elevation, as the ambiguous elevation result is far higher. In this case there is no need to resolve any ambiguity. One should remember that DeBell is performing mapping and not obstacle detection and thus he does not need to look close to the LOF.

Therefore, It is not obvious for DeBell to employ such elevation ambiguity resolution (nor is it called for in other SAR applications, in which the antenna looks down and away from the LOF). Such elevation ambiguity is definitely needed in the present invention. Simply stated, the system of DeBell has no ambiguity to resolve.

Similarly, the antenna of Haupt is solving a problem that is not present in DeBell, since DeBell (in performing terrain mapping) does not look close to the line of flight and thus does not need an antenna having a null.

As to claim 37 The examiner rejects this claim based on Boles (4,546,354, column 9, lines 5-9). Applicant respectfully submits that the Examiner has confused ***coherent*** integration (the essence of FFT performed in each filter), with the subject of the claim, which is ***incoherent*** addition:

As claimed the results of a number of adjacent Doppler filters related to relatively large angles away from the LOF are added. This corresponds to incoherent addition.. This can result in an improvement in signal to noise ratio, as this adding is equivalent to ***non coherent (or post detection) integration*** (as in non coherent integration of pulses).

Boles only says that the FFT processors perform ***coherent*** integration of signal samples, such that these add up ***coherently*** to form vectors (phasors) in all the filters at the same time. Each such phasor has a different Doppler frequency, and therefore represents a different angle. Adding these vectors incoherently will widen the sectors on the ground (or surface) and increase the cross range resolution, thus degrading the quality of the SAR mapping. What we claim and what Boles says are two different things, so there is no *prima facie* reason to reject claim 37 based on Boles.

As to claim 40 Kennedy does not look for discontinuity of backscatter in the elevation plane as claimed. All he does is accentuate backscatter which comes from points lying in the rotor plane. When he detects a backscatter from the rotor plane, this does not mean that there was no backscatter from below the rotor plane. According to Kennedy's method, if a tall ground object (such as a pylon) protrudes through the rotor plane and has enough radar cross section, it will be detected and displayed like a wire.

Applicant submits that the application is now in order for allowance. Notice to that effect is respectfully solicited. Should the Examiner have any questions or suggestion for advancing the case to allowance, he is respectfully requested to call the undersigned at 1-877 428-5468. This is a direct toll-free number to the undersigned's office in Israel. Israel is 7 hours ahead of Washington.

The undersigned expects to be in Washington on or about October 17 and would like to arrange a personal interview for that date, to clear up any outstanding issues so that the case can be allowed before November 1. It is expected that the inventor will also attend the interview.

Respectfully submitted,
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